Livestock Nutrition Update

VOLUME 18 NO. 3 February 2008

TABLE OF CONTENTS

TOPIC

FEATURE ARTICLE

Published by Livestock Knowledge Centre, Manitoba Agriculture, Food and Rural Initiatives, 204-545 University Crescent, Winnipeg, Manitoba, Canada, R3T 5S6

Livestock Nutrition Update can be located on the Internet:
www.gov.mb.ca/agriculture/livestock/index.html

Karen Dupchak, M.Sc.
Animal Nutritionist
(204) 945-7668

GROWINGOpportunities

Prepared by Manitoba Agriculture, Food and Rural Initiatives

Manitoba

FABABEANS - THE NEXT CINDERELLA CROP ?

Ron Bazylo, Farm Production Extension Specialist-Swine

The vast majority of ethanol plants in the United States use corn as the feed stock. In 2005, 13% of the US corn crop was used for ethanol production but by 2006 about 2.15 billion bushels or one-fifth of the entire US corn crop will be devoted to this industry. This resulted in a reduced corn supply and higher prices for feed grains. As a result it has a dramatic impact on the swine industry. The ethanol industry has tripled in the past five years and more expansion is planned.

With the higher price of barley and corn, swine producers may want to look at fababeans for replacement of all their soybean meal and some of the cereals in the diets. Years ago, fababeans could not constitute a very large portion of diets due to high tannin levels. Now there are new zero tannin (ZT) varieties such as Snowbird that can be fed to pigs without affecting feed intake and performance.

Fababeans grow to a height of 2-3 feet and can yield as high as 3400 pounds per acre. Another important feature is that fababeans fixate the most nitrogen as compared to other pulse crops grown in Western Canada. They should be grown on soils that have less than 30 pounds of nitrogen in the top twelve inches of the soil. Fababeans should be seeded in late April if possible as they poorly withstand hot conditions when flowering.

Fababeans are a large seed crop that depending on the variety needs a growing season of about 94 to 102 days. Seed rates of 150 to 180 pounds per acre are a significant part of the input costs.

Tests were conducted with ZT fababeans by Alberta Agriculture, Food and Rural Development, Agrifood Canada and Alta and Sask Pulse Growers. ZT fababeans were included at rates as high as 33% in grower diets and 19% for finisher diets which replaced all the soybean meal or peas. The results of feeding ZT fababeans (Snowbird variety) as the sole source of supplemental protein in hog diets showed no difference on animal performance, carcass traits, separable pork yield or quality.

ZT fababeans will become an emerging pulse crop and is gaining popularity. It has the potential to replace imported soybean meal and locally grown peas.

CHANGES TO CFIA'S TABLE 4: RANGE OF NUTRIENT GUARANTEES FOR COMPLETE FEEDS

Source: http://www.inspection.gc.ca/english/anima/feebet/consult/consult-table4e.shtml
Proposed changes to Table 4 can be viewed at the above CFIA website.

The Canadian Food Inspection Agency (CFIA) regulates livestock feeds and feed ingredients in Canada, under the federal *Feeds Act* and *Regulations*. Schedule I, Table 4 ("Range of nutrient guarantees for complete feeds") of the *Feeds Regulations* sets out the ranges of nutrients that complete feeds must contain to be exempt from registration. The CFIA is planning to update the nutrient guarantee ranges in Table 4 of Schedule I for chickens, turkeys, swine, and dairy and beef cattle, via the regulatory amendment process (publication in *Canada Gazette*, Parts I and II).

Prior to the current *Feeds Regulations, 1983* coming into effect, the majority of mixed feeds marketed in Canada required mandatory annual registration (i.e. formal evaluation and approval prior to manufacture, sale or importation). As the *1983 regulations* were being developed, consultation and negotiation with the commercial feed industry examined mechanisms to exempt certain groups of feeds from registration. One such mechanism was to develop a table of common nutrients and establish ranges for these nutrients in finished, complete feeds for several food-producing animal species. Complete feeds, or those manufactured from more concentrated feed products (e.g. supplements, premixes), containing the nutrients within the ranges identified, would be considered by federal regulators as generally safe and effective for the livestock species and stage of production intended (e.g. growth, maintenance, breeding, etc.).

This table was not intended to set absolute nutritional limits for livestock feeding programs but rather to establish safety ranges for the vitamin and mineral nutrients listed as a basis to exempt feeds from registration. Establishment of the nutrients and their ranges were largely based on the nutrient levels in common use at the time for standard/average feeds in a production setting. Minimum and maximum levels were determined by consulting published references such as the National Research Council (NRC) guidelines and were not intended to extend to the outer limits of safety.

Through negotiations and consultations between Agriculture Canada, the Expert Committee on Animal Nutrition, and commercial feed industry representatives, Table 4 of Schedule I was created and incorporated as part of the *Feeds Regulations*, 1983 (SOR/83-593).

Current Review

The Animal Nutrition Association of Canada (ANAC) submitted a formal request to amend values in Table 4 in 2001. The CFIA and ANAC agreed to a complete review of all Table 4 nutrients for swine, poultry, and beef and dairy cattle. The CFIA proceeded to contract individual nutrition experts for each species to provide nutritional advice to inform the process. Nutritionists identified to participate in the review were instructed to consider each class of animal within the species, and recommend changes based on scientific literature and standard feeding practices. Table 4 minimums were to reflect nutrient minimums in a production setting as a starting point, and to take into consideration NRC or any special circumstances (e.g. other sources of scientific information, vitamin stability). Table 4 maximums were to reflect a maximum nutritional value, versus a maximum tolerable concentration.

NUTRIENT VALUE OF HIGH OIL CANOLA MEAL

The majority of canola meal available in Canada is produced by solvent extraction. This process results in the most efficient removal of oil for human consumption. Other methods of oil extraction include cold pressing and expeller extraction. These are mechanical processes with high temperatures also being used in the expeller extraction. The cold press and expeller processes extract less oil from the seed resulting in canola meal with a higher fat content and therefore a higher energy value for livestock feeding. Cold press extracts the least amount of oil.

The following table shows some of the general differences in nutrient values of canola meal produced by the expeller and solvent extraction methods. (Source: Australian Canola Meal Guide for the Feed Industry, 2007).

Nutrient, 100 %DM	Expeller extracted CM	Solvent extracted CM
Dry matter	92.9	89.3
Crude protein, %	39.1	41.8
UIP, % of CP	30.0	35.0
Crude fat, %	11.9	3.8
Crude fibre, %	11.4	11.0
Glucosinolates (μmoles/g)	5.7	1.9
Lysine, %	2.12	2.26
Methionine, %	0.75	0.81
DE(swine), mcal/kg	3.57	3.32
TDN, % (MAFRI calc)	81	73

The high oil canola meal currently available in Manitoba is produced by expeller extraction. The following table shows nutrient data that can be used for canola meal produced by this process.

Nutrient, 100% DM	Expeller Extracted CM[1]	Solvent Extracted CM[2]
Crude protein, %	39	38.9
UIP, % of CP	-	35
Crude fat, %	11.7	3.9
Crude fibre, %	14.4	13.3
ADF, %	21.9	19.1
NDF, %	30.3	23.6
Calcium, %	0.56	0.7
Phosphorus, %	1.11	1.2
Sulfur, %	0.8	0.94
Lysine, %	-	2.2
Methionine, %	-	0.86
TDN, %	82	70
$NE_{L,\ mcal/kg}$	1.89 (MAFRI calc)	1.76
DE (mcal/kg)	3.94	3.44

[1] Associated Proteins, 2007
[2] Canola Meal Feed Industry Guide, Canola Council of Canada, 2001.

MILK REPLACERS FOR DAIRY CALVES

Consider the following when evaluating and purchasing milk replacers for your calves.

Protein
Milk replacers should contain 20 - 22% protein. For calves younger than 2-3 weeks of age, the protein should come solely from milk sources such as whey protein derivatives. The addition of non-milk protein sources, such as soy protein, has been repeatedly shown to decrease growth and feed efficiency. Plant proteins contain anti-nutritional factors which cause many problems including gut inflammation, poor growth, diarrhea, discomfort, intestinal damage, and changes in immune response. Older calves are better able to digest plant proteins although performance is still often lower compared to calves fed milk protein.

A research trial by Drackley et al, (J. Dairy Sci, May 2006) compared the performance of calves from birth to 4 weeks of age fed either 1. all-milk-protein milk replacer 2. milk replacer with 60% of the milk protein replaced by soy protein concentrate (SPC) and 3. the SPC milk replacer plus 1% glutamine. Glutamine is believed to play a role in maintaining gut health and it was hoped that adding glutamine to a SPC milk replacer would help lessen the impact of SPC on performance and intestinal function. The researchers found that calves grew significantly better (a 17% improvement) on the all-milk- protein milk replacer than on the SPC milk replacer. The addition of glutamine had no effect on calf performance.

Energy
Young calves have very limited ability to digest carbohydrates other than lactose. Sugars, such as table sugar, corn syrup and molasses, as well as starch, from cereal grains and molasses, are poorly digested and may result in diarrhea when fed to young calves. Energy is, therefore, provided primarily by the fat in milk replacers. Milk replacers with a higher fat content will have a higher energy value. Tallow, choice white grease or lard, specially processed to improve digestibility, are the main fat sources.

Whole milk averages 30% fat, on a dry matter basis. The fat content in commercial milk replacers can range from 10-25% although most contain 18-25% fat. Milk replacers with 20-25% fat are recommended for calves in colder climates. Young calves have a high energy requirement and are also poorly equipped to deal with cold temperatures due to low body fat reserves and a short hair coat. A higher fat milk replacer will allow calves to build body fat reserves which helps to keep them alive and growing when stressed by colder temperatures.

Vitamins and Minerals Required concentrations of minerals and vitamins for milk replacer fed at 0.53kg of DM per day to 45 kg calf. (Nutrient Requirements of Dairy Cattle, Seventh Revised Edition, 2001)

Nutrient	Level in MR	Nutrient	Level in MR
Ca %	1.00	Cu, mg/kg	10
P %	0.70	I, mg/kg	0.50
Mg %	0.07	Co, mg/kg	0.11
Na %	0.40	Se, mg/kg	0.30
K %	0.65	Vitamin A, IU/kg DM	9,000
Fe, mg/kg	100 (for veal calves should be <50mg/kg)	Vitamin D, IU/kg DM	600
Mn, mg/kg	40	Vitamin E, IU/kg DM	50
Zn, mg/kg	40		

B-complex vitamins are also required in the following concentrations (mg/kg DM): thiamin, 6.5; riboflavin, 6.5; pyridoxine, 6.5; pantothenic acid, 13.0; niacin, 10.0; biotin, 0.1; folic acid, 0.5; B_{12} 0.07; choline, 1,000.

High quality milk replacers with 20-22% protein (all milk sources) and 18-20% fat are expensive but the money will be well spent! Do not plan on skimping during the first three weeks of a calf's life!

The Impacts of Energy and Protein Nutrition on Fertility in Dairy Cows

Sources: Butler, R. 2005. Relationships of dietary protein and fertility. Advances in Dairy Technology 17: 159
Spain, J. 2005. Implementing a nutritional management strategy to enhance fertility. Advances in Dairy Technology 17: 171.

Energy Nutrition

The bulk of research shows that the extent and length of negative energy balance in early lactation affects interval to first ovulation, silent heats and days open.

All early lactation dairy cows are in negative energy balance due to the gap between a typical lactation curve and the typical dry matter intake curve. Milk production increases sharply after calving and peaks approximately 6-8 weeks post calving. Dry matter intake increases slowly after calving and reaches a maximum at 10-12 weeks after calving. The resulting gap between the two is the time of negative energy balance (NEBAL). A dairy cow will compensate for this difference by mobilizing body fat stores as an energy source.

NEBAL affects fertility both directly through changes in hormone levels and indirectly through the effects of body fat mobilization. When body fat is mobilized for energy, free fatty acids and ketones are released into the blood. They are transported to the liver for conversion to glucose, the body's main energy source. If the mobilization is extreme, the fatty acids will accumulate in the liver, increasing the fat content and reducing the synthesis of glucose.

Extreme losses in body condition (>3 lbs/day) typically result in longer days to 1st ovulation, days to 1st service and decreased conception rate resulting in increased number of days open. Rapid losses of body condition in early lactation also predispose cows to metabolic diseases such as ketosis. Minimizing drops in body condition in early lactation should be one of the main goals of a feeding program. Management for this should begin in late lactation, proceed through the close-up dry period and continue through early lactation. Consider the following points:

- Aim for a BCS of 3-3.5 at dry off. Heavier cows eat less and are prone to metabolic diseases.
- Adjust BCS during the last 100 days of lactation. Energy utilization is better when a cow is lactating and this means less grain will be needed to improve BCS. Fat cows should be placed on a lower energy lactation ration so weight loss occurs when milking - not during the dry period.
- Nutrient density (including energy) of the close-up and early lactation rations will need to increase to compensate for the drop in DMI which occurs prior to calving and for the increased energy requirement. DMI begins to decrease 2-3 weeks prior to calving due to changes in circulating hormones and will drop to less than 1% of body weight by calving.
- Pay attention to protein levels in the close-up dry period. Low CP levels during this time are associated with decreases in feed intake after calving.
- Lead feeding will provide additional energy and help adapt the rumen for higher grain intakes to follow. Limit the amount of grain at calving to 0.5-0.75% BW – approximately 8-10 lbs.
- Provide good quality, palatable forage and avoid unpalatable feed ingredients.
- Provide 4-5 lbs long hay after calving to stimulate rumen function.
- A TMR will provide a constant forage:concentrate ratio and minimizing the risk of acidosis.
- Have feed available 20-24 hours a day.
- Provide free choice, good quality water. Early lactation cows will require 115-130 L/day.

- Reduce stress and its negative impact on dry matter intake by considering cow comfort (ventilation, stall design, social changes etc)
- Feed additives such as niacin and monensin may be useful in improving energy balance.

Protein Nutrition

Studies show feeding diets with high %CP (over 18%) may lead to decreased reproductive performance in dairy cows. Both components of crude protein – the rumen degradable protein (RDP) and rumen undegradable protein (RUP) -need to be considered when evaluating protein nutrition.

The RDP provides a rapid, readily available source of ammonia (nitrogen) for the rumen microbes. The nitrogen is used in the synthesis of microbial protein which is a source of protein to the dairy cow. If ammonia is present at levels above that which can be utilized by microbes, the excess is absorbed into the bloodstream, transported to the liver, converted to urea and excreted. RUP provides a source of intact dietary amino acids to the small intestine. Amino acids, in excess of those needed for milk protein, are also transported to the liver where they are converted to urea and subsequently excreted.

Excess urea production causes an increase in BUN levels (blood urea nitrogen). Elevated BUN levels have been shown to alter the uterine environment and may decrease fertility through changes in uterine pH and mineral levels as well as increased urea in uterine fluids. High protein levels may also have an indirect effect on fertility by worsening the existing NEBAL. There is an energy cost associated with converting excess ammonia to urea and this may lower the amount of energy available to the cow for production.

It appears that cows in NEBAL have increased sensitivity to the effects of urea in the uterus, possibly due to low progesterone levels. This may explain why not all studies show a decrease in fertility when high protein levels are fed.

The goal of protein feeding is to minimize ammonia spikes in the rumen. Consider the following suggestions to optimize protein nutrition in a dairy cow.

- Dilute high RDP feeds with feeds of lower RDP. For example, barley and wheat have an RDP of about 75% while corn has an RDP of only 50%. A soluble protein (SP) test is a rapid, inexpensive test available on forages and is an indicator of RDP. Soluble proteins can be quite variable among different forages. Mix forages with higher SP with those of lower SP.
- Feed dry hay (SP 25-30%) along with silages (SP 60-70%).
- Remove sources of added urea from the feed (eg. ammoniated silage, protein concentrates containing urea)
- Incorporate protein sources high in RUP. DDGS and roasted soybeans have RUP values of 50-55% compared to canola meal and soybean meal with RUP values of 35%.
- Feed a readily available energy source along with high RDP feeds. This provides energy to the rumen microbes and helps to maximize microbial protein synthesis while reducing the amount of excess ammonia.
    - Choose a rapidly degradable grain such as barley or wheat over corn which has a much slower rate of starch degradation in the rumen.
    - Grind grain to increase digestibility.
    - Feed the grain on top of forage or utilize a TMR.
- Use MUN values to evaluate protein nutrition. High MUNs have been associated with lower conception rates.
- Consider amino acid balance when balancing rations. Ideally the overall crude protein level in a dairy diet could be reduced if all amino acids were correctly balanced. This is a difficult thing to achieve in a dairy diet. However, feeding a wide variety of feeds will help ensure that no single amino acid becomes limiting. For example, diets containing corn silage, corn grain and corn DDGS may well become limiting in lysine. This will help to improve the overall efficiency of protein metabolism.